CHAPTER 3

BIODIVERSITY

MULTIPLE CHOICE QUESTIONS

1. **How many organisms inhabit the earth?**
   (a) 10 million (b) 15 million (c) 5 million (d) 20 million
2. **The plants present in a particular region:**
   (a) Flora (b) Fauna (c) Biodiversity (d) Ecosystem
3. **The animals present in a particular region:**
   (a) Species (b) Genus (c) Fauna (d) Biodiversity
4. **Biodiversity found on earth today is the result of how many years of evolution?**
   (a) 3 billion (b) 4 billion (c) 5 billion (d) 6 billion
5. **The branch of Biology which deals with classification and traces the evolutionary history of organisms:**
   (a) Taxonomy (b) Systematics (c) Embryology (d) Ethology
6. **A class is a group of related:**
   (a) Phylum (b) Order (c) Family (d) Genus
7. **A genus is a group of related:**
   (a) Class (b) Family (c) Phylum (d) Species
8. **The order of pea plant:**
   (a) Pisum (b) Fabales (c) Magnoliophyta (d) Plantae
9. **The family of human being:**
   (a) Chordata (b) Mammalia (c) Primates (d) Hominidae
10. **The basic unit of classification:**
    (a) Genus (b) Order (c) Homo (d) Species
11. **The cross between a male donkey and a female horse produces:**
    (a) Mule (b) Pony (c) Liger (d) None of these
12. **Divided plants into fifteen groups and called them "genera":**
    (a) John Ray (b) Tournefort (c) Linnaeus (d) Caesalpino
13. **Introduced the taxon of "order":**
    (a) Tournefort (b) Linnaeus (c) Rivinus (d) Lamarck
14. **In which year three kingdom classification system was proposed?**
    (a) 1860 (b) 1862 (c) 1864 (d) 1866
15. **Who proposed three kingdom classification system?**
    (a) E-Chatton (b) Robert Whittaker (c) Ernst Hackel (d) Margulis
16. **In which year five kingdom classification system was proposed?**
    (a) 1965 (b) 1966 (c) 1967 (d) 1968
17. **Who proposed five kingdom classification system?**
    (a) E-Chatton (b) Robert Whittaker (c) Ernst Hackel (d) Margulis
18. **In which year Margulis and Schwartz modified the five kingdom classification system?**
    (a) 1884 (b) 1886 (c) 1888 (d) 1890

19. **According to Biologists, the protists are the ancestors of:**
(a) Plantae (b) Fungi (c) Animalia (d) All of these

20. **Which organisims are composed of only proteins?**
(a) Prions (b) Viriods (c) Viruses (d) Bacteria

21. **Which organisims are composed of circular RNA only?**
(a) Prions (b) Viriods (c) Viruses (d) Bacteria

22. **Scientific name of onion:**
(a) *Allium cepa* (b) *Asterias rubens* (c) *Corvus splendens* (d) *Homo sapiens*

23. **Scientific name of house crow:**
(a) *Allium cepa* (b) *Asterias rubens* (c) *Corvus splendens* (d) *Homo sapiens*

24. **Scientific name of star fish:**
(a) *Allium cepa* (b) *Asterias rubens* (c) *Corvus splendens* (d) *Homo sapiens*

25. **What was the population of earth 10,000 years ago?**
(a) 2 million (b) 3 million (c) 4 million (d) 5 million

26. **How many people are added in human population each day?**
(a) 240,000 (b) 250,000 (c) 260,000 (d) 270,000

27. **Which one is the greatest threat to biodiversity on earth today?**
(a) Species introduction (b) Pollution (c) Habitat Loss (d) Hunting

28. **Which organization prepared the first national Red List of Pakistan?**
(a) WWF-P (b) IUCN (c) NACP (d) HJP

29. **When Pakistan signed UN Convention on Combating Desertification:**
(a) 1995 (b) 1996 (c) 1998 (d) 1997

30. **When was Himalayan Jungle Project started?**
(a) 1990 (b) 1991 (c) 1992 (d) 1993

31. **How many birds are killed during migration?**
(a) 100,000 (b) 200,000 (c) 300,000 (d) 400,000

32. **How many animals of Indus Dolphin are left today in the Indus river?**
(a) 300 (b) 400 (c) 500 (d) 600

33. ***Houbara bustard* flies to Pakistan in:**
(a) Summer (b) Spring (c) Autumn (d) Winter

34. **The National animal of Pakistan:**
(a) Markhor (b) Snow leopard (c) Chakor partridge (d) Brown bear

35. **The National bird of Pakistan:**
(a) Markhor (b) Snow leopard (c) Chakor partridge (d) Brown bear

ANSWERS:

1	a	2	a	3	c	4	b	5	b
6	b	7	d	8	b	9	d	10	b
11	a	12	d	13	c	14	d	15	c
16	c	17	b	18	c	19	d	20	a
21	b	22	a	23	c	24	b	25	d
26	c	27	c	28	b	29	d	30	b
31	b	32	d	33	d	34		35	

SHORT QUESTIONS

Q. No. 1 How many kinds of organisms are present on the earth?

SPECIES RECORD

The earth is inhabited by at least 10 million kinds of organisms, but less than one-third of these have been studied and catalogued (put in record) by biologists.

Q. No. 2 Define biodiversity.

BIODIVERSITY

Meaning:

The term 'Biodiversity' has been derived from two terms.
'bio' Life
'diversity' variety

Definition:

The measure of the variety of organisms present in different ecosystems is called biodiversity.

- It refers to variety within species and among species.

Q. No. 3 What do you mean by flora and fauna.

FLORA

The diversity of plants in a particular region is called Flora.

FAUNA

The diversity of animals in a particular region is called Fauna.

Q. No. 4 On what factors the flora and faune of a region depend?

DEPENDENCE OF FLORA AND FAUNA

The flora and fauna in a region depend on:

- Climate
- Altitude
- Soils
- Presence of other species

Q. No. 5 How biodiversity is not distributed evenly on earth?

DISTRIBUTION OF BIODIVERSITY

Biodiversity is not distributed evenly on Earth:

Tropics:
It is richest in the tropics.

Temperate Regions:
Temperate regions also have many species.

Polar Regions: Polar regions have fewer species.

Q. No. 6 How biodiversity has evolved?

EVOLUTION OF BIODIVERSITY

Biodiversity found on earth today is the result of 4 Billion years of evolution.

Q. No. 7 What do you know about the origin of life on earth?

ORIGIN OF LIFE ON EARTH

The origin of life is not well known to science, though limited evidence suggests that until 600 million years ago, all life consisted of bacteria and similar unicellular organisms.

Q. No. 8 Write the classification of human being.

CLASSIFICATION OF HUMAN BEING

Taxa	Human
Kingdom	Animalia
Phylum	Chordata
Class	Mammalia
Order	Primates
Family	Hominidae
Genus	*Homo*
Specie	*H.Sapiens*

Q. No. 9 Write the classification of pea plant.

CLASSIFICATION OF PEA PLANT

Taxa	Pea
Kingdom	Plantae
Phylum	Magnoliophyta
Class	Magnoliopsida
Order	Fabales
Family	Fabaceae
Genus	*Pisum*
Specie	*P.Sativum*

Q. No. 10 In which species the criteria for interbreeding can not be used?

USAGE OF CRITERIA OF INTERBREEDING

The criteria of interbreeding cannot be used for species recognition in organisms who reproduce asexually and do not interbreed with one another.

Example:

- Many unicellular organisms

Q. No. 11 What is the role of E-Chatton?

ROLE OF E-CHATTON

In 1937, E-Chatton suggested the terms of 'Procaryotique' to describe bacteria and 'Eucariotique' to describe animal and plant cells.

Q. No. 12 What is the basis of five-kingdom classification system?

BASIS OF FIVE KINGDOM CLASSIFICATION

- **Cellular organization:** The levels of cellular organization, i.e. prokaryotic, unicellular eukaryotic and multicellular eukaryotic.
- **Modes of nutrition:** The principle modes of nutrition, i.e. photosynthesis, absorption, and ingestion.

Q. No. 13 How can you divide five kingdoms into two groups on the basis of types of cells?

DIVISION OF FIVE KINGDOMS INTO TWO GROUPS ON THE BASIS OF TYPES OF CELLS

1. Kingdom Monera (organisms with prokaryotic cells)
2. Kingdom protista, fungi, plantae, animalia (organisms with eukaryotic cells)

Q. No. 14 What are prions and viroids?

PRIONS AND VIROIDS

Prions and viroids are acellular forms of organisms. Both of these entities cause infectious diseases in certain plants. They are not included in five-kingdom classification.

Prions are composed of proteins only.

Virioids are composed of circular RNA only.

Q. No. 15 What do Biologists urge on national policy makers?

BIOLOGISTS DIRECTIONS TO POLICY MAKERS

Biologists urge the national policy makers to state a set of rules necessary to protect a species. They demand that laws should define species which are threatened by extinction and must be protected.

Q. No. 16 Write names of animals to which Northern Areas provide habitat.

ANIMALS OF NORTHERN AREAS

The Northern Areas of Pakistan provide habitats:

- Musk deer
- Snow leopard
- Astore Markhor
- Himalayan Ibex
- Woolly Flying Squirrel
- Brown Bear

Q. No. 17 How many migratory birds are killed each year?

KILLING OF MIGRATORY BIRDS

It is estimated that about 200,000 of the one million migratory birds passing through Chitral are killed during migration.

Q. No. 18 What do herders do with bear cubs?

CAPTURING OF BEAR CUBS

The herders capture the bear cubs and sell them to the trainers who train them and sell them to the foreigners.

Q. No. 19 What are the main causes of loss of biodivarsity in Pakistan?

CAUSES OF LOSS OF BIODIVARSITY

Pakistan today faces severe threats to its animal and plant species. The main causes of this loss are:

- Loss of natural habitats
- Rapid growth in human population
- Prevailing poverty in rural areas
- Low literacy rate

Q. No. 20 Which organizations are working for the conservation of biodiversity?

ORGANIZATIONS FOR THE CONVERSION OF BIODIVERSITY

The following organizations are working for the conservation of biodiversity in Pakistan.

- The International Union for the Conservation of Nature and Natural Resources (IUCN)
- World Wildlife Fund Pakistan (WWF-P)
- Pakistan's Ministry of Environment
- Other government and non-government institutions

Q. No. 21 Which organization has prepared first red list of Pakistan?

FIRST RED LIST OF PAKISTAN

The IUCN has prepared the first national Red List (list of endangered or threatened species).

Q. No. 22 Which is the national animal of Pakistan?

NATIONAL ANIMAL OF PAKISTAN

Markhor is the national animal of Pakistan.

Q. No. 23 Which is the national bird of Pakistan?

NATIONAL BIRD OF PAKISTAN

Chakor Patridge is the national bird of Pakistan.

Q. No. 24 Describe the importance of biodiversity.

IMPORTANCE OF BIODIVERSITY

The biodiversity is important in many ways.

i. **Food:**
Biodiversity provides food for humans.

ii. **Drugs:**
A significant proportion of drugs are derived directly or indirectly from biological sources.

iii. **Industrial materials:**
A wide range of industrial materials, e.g. building materials, fibers, dyes, resins, gums, adhesives, rubber, and oil are derived directly from plants.

iv. **Maintenance of Ecosystems:**
Biodiversity plays an important role in making and maintaining ecosystems.

v. **Environmental Benefits:**
It helps in regulating the chemistry of our atmosphere and water supply.

vi. **Recycling:**
Biodiversity is directly involved in recycling of nutrients and providing fertile soils.

Q. No. 25 How many types of animals and plants are known to biologists?

NUMBER OF ANIMALS AND PLANTS

Over **1.5 million** types of animals and over **0.5 million** types of plants are known to biologists.

Q. No. 26 Why does it become difficult to learn about the characteristics of each species?

DIFFICULTY IN LEARNING OF CHARACTERISTICS OF EACH SPECIES

- They range in complexity from small and simple bacteria to large and complex human beings.

- Some of them live in sea, others on land. Some walk, others fly. And still others are stationary.
- Each has its own way of life, i.e. getting food, avoiding unfavorable environmental conditions, finding a place to live, and reproducing its kind.

LONG QUESTIONS

Q. No. 1 What is classification. Describe its aims and basis.

CLASSIFICATION

Need of Classification:

To study such a large collection, biologists classify organisms into groups and subgroups.

Biological Classification:

The method by which biologists divide organisms into groups and subgroups on the basis of their similarities and differences is called biological classification.

Taxonomy:

The branch of biology which deals with classification of organisms is called Taxonomy.

Systematics:

The branch of biology which deals with classification and also traces the evolutionary history of organisms is called Systematic.

AIMS OF CLASSIFICATION

Following are the aims of classification:

- To determine similarities and differences among organisms so that they can be studied easily.
- To find the evolutionary relationships among organisms.

BASIS OF CLASSIFICATION

Classification is based on relationships amongst organisms and such relationship is got through similarities in characteristics. These similarities suggest that all organisms are related to one another at some point in their evolutionary histories. However, some organisms are more closely related than others.

Example:

Sparrows are more closely related to pigeons than to insects. It means that the former two have common evolutionary histories.

Traits of similarities:

When biologists classify organisms into groups and subgroups, similarities are seen in:

- External structures
- Internal structures
- Stages of development

Role of Modern Genetics:

Modern genetics provides important information to taxonomists. The similarities and differences in the DNA of two studied organisms can be used for getting idea about similarities and differences in their structure and functions.

Q. No. 2 Write a note on Taxonomic Hierarchy.

TAXONOMIC HIERARCHY

Taxa:

The groups into which organisms are classified are called as Taxa.

- The singular of 'Taxa' is a 'Taxon'.

Taxonomic Hierarchy:

The taxa form a ladder, called as 'Taxonomic Hierarchy'.

Divisions of Organisms:

All organisms are divided into 5 kingdoms. So kingdom is the largest taxon. On the basis of similarities, each kingdom is further divided into smaller taxa in the following way:

Kingdom:

A kingdom is a group of related phyla.

Phylum:

A phylum is a group of related classes. (**Division:** For plants & fungi)

Class:

A class is a group of related orders.

Order:

An order is a group of related families.

Family:

A family is a group of related genera.

Genus:

A genus is a group of related species.

Species:

A species consists of similar organisms.

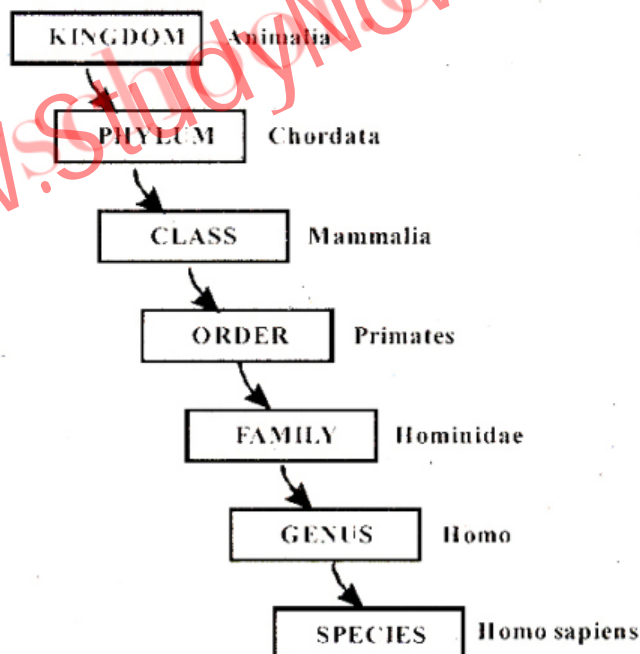



Figure: Taxonomic Hierarchy

Q. No. 3 Write a note on species.

SPECIES

Introduction:

A species is the basic unit of classification.

Definition:

A group of organisms which can interbreed freely among them and produce fertile off springs. but are reproductively isolated from all other groups in nature is called as species.

Distinct characteristics:

A species possesses its own distinct characteristics like:

- Structural
- Ecological
- Behavioral

Explanation:

In the definition of species, we must emphasize 'in nature' because two organisms related to two different but closely related species can cross-breed under artificial conditions. But in such unnatural crosses. they produce an infertile offspring.

Example:

A cross between a male donkey and a female horse produces an infertile offspring.

- Mule

Limitation of Interbreeding Criteria:

The criteria of interbreeding cannot be used for species recognition in organisms who reproduce asexually and do not interbreed with one another.

Example:

- Many unicellular organisms

Q. No. 4 Write a note on history of classification systems.

HISTORY OF CLASSIFICATION SYSTEMS

The following scientists contributed in the history of classification systems:

Aristotle:

The earliest known system of classification of organisms comes from the Greek philosopher Aristotle. He classified all living organisms known at that time in two groups:

- Plantae
- Animalia

Abu-Usman Umer Aljahiz:

In 700s. Abu-Usman Umer Aljahiz described the characteristics of 350 species of animals in his book. He wrote a lot about the life of ants.

Ibn Rushd (Averroes):

In 1172. Ibn Rushd translated Aristotle's book 'de Anima' (on the soul) in Arabic.

Andrea Caesalpino:

Period: (1519-1603 AD)

Contribution: Divided plants into fifteen groups and called them 'genera'.

John Ray:

Period: (1627-1705 AD)

Contribution: Published important work on plant classification.

Augustus Rivinus:

Period: (1652-1723 AD)

Contribution: Introduced the taxon of 'order'.

Tournefort:

Period: (1656-1708 AD)

Contribution: Introduced the taxa of 'class' and 'species'.

Carolus Linnaeus:

Period: (1707-1778 AD)

Contribution: Grouped species according to similar physical characteristics.

He divided nature into three kingdoms:

1. Mineral
2. Vegetable
3. Animal

He used five ranks in classification:

1. Class
2. Order
3. Genus
4. Species
5. Variety

Linnaeus is best known for his introduction of the method still used to formulate the scientific name of every species.

Preference of a System:

Biologists prefer such a system that can provide maximum information about the basic differences and similarities among different organisms.

Q. No. 5 Write a note on two-kingdom classification system.

TWO-KINGDOM CLASSIFICATION SYSTEM

Introduction:

It is the oldest of all the classification systems.

Number of Kingdoms:

According to this system, all organisms are classified into two kingdoms:

1. Kingdom Plantae
2. Kingdom Animalia

1. Kingdom Plantae:

Characteristics:

- These organisms can prepare food from simple inorganic materials.
- They can store energy.
- They are autotrophs.
- Bacteria, fungi, and algae were included in Kingdom Plantae.

2. Kingdom Animalia:

Characteristics:

- These organisms cannot synthesize their own food.
- They depend on autotrophs or other organisms for their food.
- They are heterotrophs.

Other Organisms

Objections:

Some taxonomists found this system unworkable because:

- Many unicellular organisms like *Euglena* have both plant like (presence of chlorophyll) and animal-like (heterotrophic mode of nutrition & lack of cell-wall) characters. So there should be a separate kingdom for such organisms.
- This system also ignores the difference between organisms having prokaryotic and those having eukaryotic cells.

Q. No 6 Write a note on three-kingdom classification system.

THREE-KINGDOM CLASSIFICATION SYSTEM

Introduction:

In 1866. Earnst Hackel solved the first objection and presented three-kingdom classification system.

Number of Kingdoms:

According to this system, all organisms are classified into two kingdoms:

1. Kingdom Plantae
2. Kingdom Animalia
3. Kingdom Protista

1. Kingdom Plantae:

He placed all plants and fungi in this kingdom.

2. Kingdom Animalia:

All of the animals were placed in kingdom animalia.

3. Kingdom Protista:

He proposed a third system. Protista to accommodate Euglena-like organisms. He also included bacteria in this kingdom.

Objections:

- **Difference between Prokaryotes and Eukaryotes:**
  This system did not clear the difference between prokaryotes and eukaryotes.
- **Objection on Position of Fungi:**
  Fungi were still placed in the **Kingdom Plantae.** Some biologists disagreed about the position of Fungi in kingdom Plantae. Fungi resemble plants in many ways but are not autotrophs. They are special form of heterotrophs and get their food by absorption. They do not have cellulose in their cell-walls, rather they possess Chitin.

Q. No. 7 Write a note on five-kingdom classification system.

FIVE-KINGDOM CLASSIFICATION SYSTEM

Introduction:

In 1967, Robert Whittaker introduced the five-kingdom classification system.

Basis of Five Kingdom Classification:

- **Cellular organization:** The levels of cellular organization, i.e. prokaryotic, unicellular eukaryotic and multicellular eukaryotic.
- **Modes of nutrition:** The principle modes of nutrition, i.e. photosynthesis, absorption, and ingestion.

Number of Kingdoms:

Organisms are divided into the following five kingdoms:

1. Monera
2. Protista

3. Fungi
4. Plantae
5. Animalia

Role of Margulis & Schwartz:

In 1988, Margulis and Schwartz modified the five-kingdom classification of Whittaker. They considered genetics along with cellular organization and modes of nutrition in classification. They classified the organisms into the same five kingdoms as proposed by Whittaker.

THE FIVE KINGDOMS

1. **Kingdom Monera:**

It includes prokaryotic organisms.

Characteristics:

- These organisms are made up of prokaryotic cells.
- They are unicellular.
- Some forms may form chains, clusters or colonies of cells.
- Most of them are heterotrophic.
- Some perform photosynthesis because of presence of chlorophyll in cytoplasm.
- They are radically different from eukaryotic cells.

Examples:

In this kingdom, there are two kinds of organisms:

- Bacteria
- Cyanobacteria

2. **Kingdom Protista:**

It includes eukaryotic organisms, which are unicellular or simple multicellular.

Types of Protists:

There are three main types of protists:

i. **Algae:**

- They are unicellular, colonial, or simple multicellular.
- They resemble plant cells with cell walls and chlorophyll in chloroplasts.
- Simple multicellular means that they do not have multicellular sex organs and do not form embryos during life-cycle.

ii. **Protozoans:**

- They resemble animals.
- Their cells lack cell-walls and chlorophyll.

iii. **Fungi-like:**

- Some protists resemble fungi.

3. **Kingdom Fungi:**

It includes eukaryotic multicellular heterotrophs.

Characteristics:

i. They are absorptive in their mode of nutrition.
ii. Most fungi are decomposers. They live on organic material, secrete digestive enzymes, and absorb small organic molecules formed by the digestion by enzymes.

Examples:

- Mushrooms

4. **Kingdom Plantae:**
   It includes eukaryotic multicellular autotrophs.

Characteristics:

- Plants are autotrophic in nutritional mode.
- They make their own food by photosynthesis.
- They have multicellular sex organs.
- They form embryos during their life cycles.

Examples:

- Mosses
- Ferns
- Flowering plants

5. **Kingdom Animalia:**
   It includes eukaryotic multicellular consumers.

Characteristics:

- They live mostly by ingesting food and digesting it within specialized cavities.
- They lack cell walls.
- They show movements.

Examples:

- Rabbit
- Starfish
- Monkey

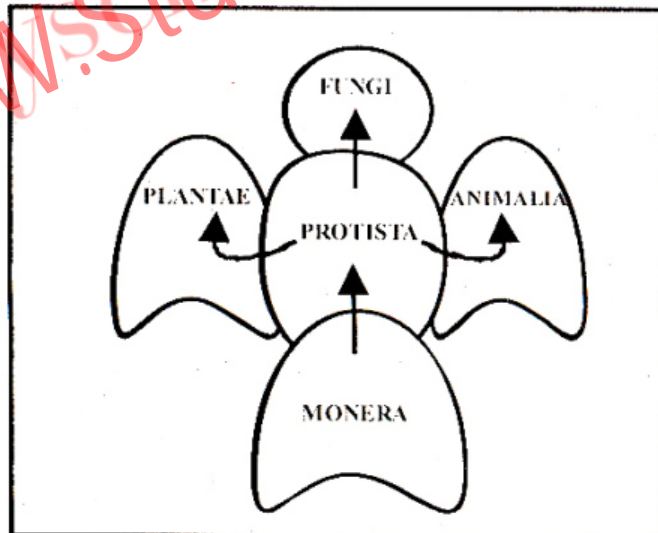



Figure: The Five Kingdoms of Classification

Opinion of Biologists:

Biologists believe that kingdom protista evolved from monera, and it gave rise to the other three eukaryotic kingdoms, i.e. fungi, plantae and animalia.

Q. No. 8 Compare the distinguishing characteristics of the five kingdoms of life.

DISTINGUISHING CHARACTERISTICS OF THE FIVE KINGDOMS

Kingdom	Cell Type	Nuclear Envelope	Cell Wall	Mode of Nutrition	Multi-Cellularity
Monera	Prokaryotic	Absent	Non-cellulose (polysaccharide plus amino acids)	Autotroph or heterotroph	Absent
Protista	Eukaryotic	Present	Present in some forms. various types	Photosynthetic or heterotroph, or combination	Absent in most forms
Fungi	Eukaryotic	Present	Chitin	Absorptive heterotroph	Present in most forms
Plantae	Eukaryotic	Present	Cellulose and other polysaccharides	Photosynthetic	Present in all forms
Animalia	Eukaryotic	Present	Absent	Ingestive heterotroph	Present in all forms

Q. No. 9 Write a note on status of viruses.

STATUS OF VIRUSES

Introduction:

Viruses are at the borderline of living & non-living.

Crystalline Nature:

Due to their crystalline nature, they are considered as non-living.

Acellular:

They are acellular, i.e. they do not have cellular organization.

Classification:

They are not considered as organisms & thus not included in 5-kingdom classification.

Structure:

They contain DNA or RNA normally encased in a protein coat.

Reproduction:

They reproduce, but only in living cells.

Parasites:

They cause a number of diseases in living cells.

Q. No. 10 Write a note on binomial nomenclature.

BINOMIAL NOMENCLATURE

Introduction:

Binomial Nomenclature is the method of giving scientific names to living organisms.

Meaning:

'bi-nomial' means 'two names'

Presentation:

Swedish biologist Carolus Linnaeus (1707-1778 AD) first introduced and adopted the system of binomial nomenclature. His system spread rapidly and became popular. Many of his names are in use today.

Basic Format:

The scientific name of a any living organism consists of two names: the first is the **genus** name and the second one is the name of the **species.**

Rules of Binomial Nomenclature:

Some of the rules which are universally adopted while suggesting and documenting scientific names. are:

- ***Italics:***
  Scientific names are usually printed in *Italics*, such as *Homo sapiens*. When handwritten, they are underlined.
- **First Letter Capital:**
  The first term (generic name) always begins with a capital letter.
  The species name is never capitalized, even when derived from a proper name.
- **Use of Abbreviation:**
  The scientific name is generally written in full when it is first used. But when several species from the same genus are being listed, it may then be abbreviated by just using an initial for genus. For example, *Escherichia coli* becomes *E. coli.*

Significance:

Different Names of Same Organism:

Different regions have different names for the same organism. For example, common name of onion in Urdu is 'piyaz', but in different regions of Pakistan it is also known as 'ganda' or 'bassal' or 'vassal'. In other countries, it has other sets of names. In science, it is known with a single name as *Alium cepa.*

Same Name for Different Organisms:

In some cases, different organisms are called by the same common name.
Example: The name 'black bird' is used both for crow as well as raven.

Common Names:

Common names have no scientific basis. For example, a fish is a vertebrate animal with fins and gills. But several common names do not fit a biologist's definition of fish like:

- Silver fish
- Cray fish
- Jelly fish
- Star fish

Name in the Honour of Scientist:

Sometimes organisms are named in honor of the research workers who described & classified them.

Example:

The Orchid tree, (Mountain-ebony) was named as *Bauhinia variegata* after the Swiss botanist Bauhin. *Bauhinia variegata* is an ornamental tree found in south-east Asia.

Advantages:

i. **Proper Scientific Names:**
Organisms can be given proper scientific names by binomial nomenclature.

ii. **Widespread use:**
The value of this system is that it is widely used.

iii. **Stability:**
This system gives stability to an organism's identification.

iv. **Unambiguous Identification:**
Every organism can be unambiguously identified with just two words.

v. **World-wide Acceptability:**
Same names can be used all over the world, in all languages avoiding difficulties of translation.

Examples:

Common Name	Scientific Name
Onion	*Allium cepa*
Common sea-star (Starfish)	*Asterias rubens*
House crow	*Corvus splendens*

Q. No. 11 Write a note on Conservation of Biodiversity.

CONSERVATION OF BIODIVERSITY

Loss to Biodiversity:
During the last century, loss of biodiversity has been increasingly observed. In the modern era, due to human actions, species and ecosystems are threatened with destruction to an extent rarely seen in Earth history.

Warning by Biologists:
Biologists warn that global ecosystem would collapse if biodiversity continues to be reduced at the same rate.

An Extinct Species:
In an ecosystem, a species is called extinct when there is no doubt that the last individual of that species has died in that ecosystem.
When species of an ecosystem becomes extinct, the stability of that ecosystem is harmed.

An Endangered Species:
A species is called 'endangered' when it is at risk of extinction in the near future.

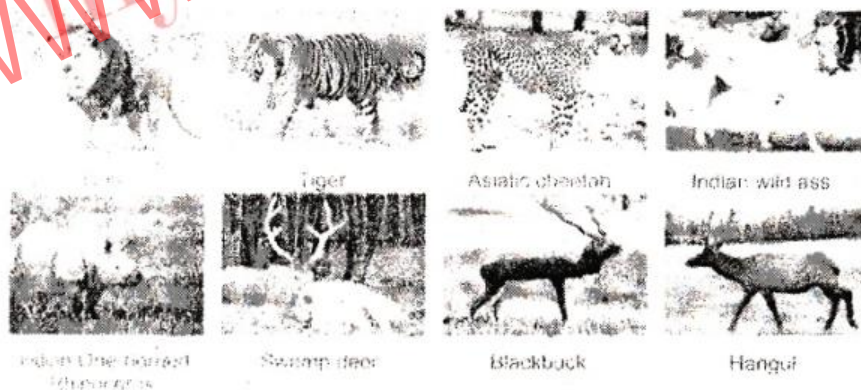



Figure: The Animals the have gone Extinct in Pakistan

Examples:
Many plant and animal species have gone extinct in Pakistan. Examples of extinct and endangered animal species are:

- Lion
- Tiger
- Asiatic cheetah

- Indian one-horned rhinoceros
- Swamp deer
- Indian wild ass
- Hangul
- Blackbuck

Q. No. 12 Describe impact of human beings on biodiversity.

IMPACT OF HUMAN BEINGS ON BIODIVERSITY

Human Population in Past:

By 10, 000 years ago, there were about 5 million people on Earth.

Today's Human Population:

With the advancement in agriculture and industry, human population began to grow rapidly. Today around 600 million people live on Earth.

Increase in Population:

More than 260,000 people are added to the world population each day, or more than 180 each minute.

Threats to Biodiversity:

To improve the living conditions for 600 million individuals, humans are imposing serious threats to the survival of biodiversity.

- Habitat loss
- Deforestation
- Over-hunting
- Introduction of new species
- Removal of species
- Pollution
- Climate change

Greatest Threat:

Habitat loss is the greatest threat to the biodiversity.

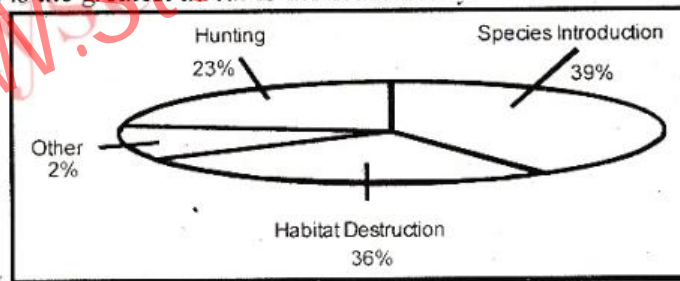
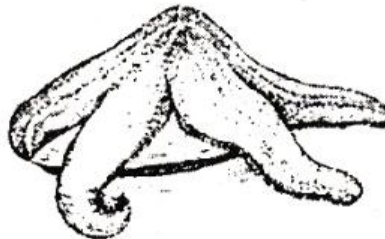



Figure: Known Causes of Species Extinction

Removal of Sea Stars from Ocean:

Sea star (starfish) eats mussels. If sea stars are removed from a region in an ocean, mussels rapidly increase in number. Large number of mussels prey on small animals and become dangerous for their existence.

Hazard by *Eucalyptus* Plant:

Eucalyptus plants were imported from Australia and introduced in Pakistan. These plants consume more water and have disturbed the water-table (level of underground water). It harms other small plants that grow near *Eucalyptus* trees.

Q. No. 14 Write a note on Deforestation and Over-Hunting.

DEFORESTATION AND OVER-HUNTING

Definition:

"The cutting down of trees for the conversion of a forest to a non-forest land is called deforestation."

Outcomes of Deforestation

The destruction of the significant areas of forests has resulted in:

- Degraded environment
- Reduced biodiversity

Types:

Sometimes there is slow forest degradation and sometimes sudden and catastrophic clear cutting for urban development.

Causes of Deforestation:

Deforestation can be the result of deliberate removal of forests for:

- Wood
- Agriculture
- Urban development

Attaining Cash:

The race to produce cash through fruits, spices, sugar, tobacco, soap, rubber, paper and cloth have stimulated many to get them by using soil and destroying the forests.

Effects of Deforestation:

Amount of Water:

Deforestation affects the amount of water in soil and moisture in the atmosphere.

Soil Erosion:

When there are no trees to keep soil in place, there are more chances of soil erosion.

Loss of Nutrients:

Heavy rainfall washes this soil into rivers. Essential nutrients are washed out of soil.

Flooding:

Rivers become choked with mud and silt, which can cause floods.

Decreased Capacity of Dams:

The silted water gets stored in dams and it reduces their water storage capacity.

Decreased Transpiration:

Deforestation contributes to decreased transpiration, which lessens cloud-formation. This ultimately reduces the sources of rains.

Long Term Losses:

Short-term economic gains made by conversion of forest to agriculture often leads to loss of long-term income.

Importance of Forests:

The following important aspects of forests are being harmed due to deforestation:

- Forests support considerable biodiversity.
- The utilization of forest products, like timber and fuel-wood, has played a key-role in human societies. In developed countries, almost 3 billion people rely on wood for heating and cooking.
- Developed countries today continue to utilize timber for building houses.
- Wood pulp is used for making paper.
- Forests extract carbon dioxide and pollutants from air, thus contributing to biosphere stability.
- Forests are also valued for their aesthetic beauty and tourist attraction.

Deforestation Khyber Pakhtunkhwa:

In the province Khyber Pakhtunkhwa, the closed canopy forests are shrinking at approximately 1% per year.

Figure: Soil erosion

Figure: Chopping up of trees for the construction of road

OVER-HUNTING

Overhunting has been a significant cause of the extinction of hundreds of species and the endangerment of many more such as:

- Whales
- Ibex
- Urial
- Markhor (the national animal of Pakistan)

Principal Threat:

Commercial hunting, both legal and illegal, is the principal threat.

Q. No. 14 Explain the steps taken for the conservation of biodiversity.

STEPS FOR THE CONSERVATION OF BIODIVERSITY

Though rich in biodiversity, Pakistan today faces severe threats to its animal and plant species.

Organizations:

The International Union for the Conservation of Nature and Natural Resources (IUCN) and World Wildlife Fund-Pakistan (WWF-P) work in close coordination with Pakistan's Ministry of Environment and other government and non-government institutions.

Preparation of Red List:

The IUCN has prepared the first national Red List (list of endangered or threatened species).

Following are a few examples of environmental work that has been carried out in Pakistan inorder to conserve species and associated habitats.

1. **National Conservation Strategy:**

   In 1980's, IUCN and the government of Pakistan formulated the National Conservation Strategy for Pakistan for the conservation of Pakistan's biodiversity.

2. **UN Convention on Combating Desertification (CCD):**

   This is an international treaty against damage and poverty in drylands. Pakistan signed this in 1997.

3. **Himalayan Jungle Project (HJP):**

   It started in 1991 in the Palas Valley, in Khyber Pakhtunkhawa (KP). It aimed at protecting one of the richest areas of biodiversity in Pakistan.

4. **Conservation of biodiversity of the Suleiman Range, Balochistan:**

   Suleiman Range Chilghoza Forest is the largest Chilghoza forest in the world. In 1992, the WWF-P started its conservation program.

5. **Northern Areas Conservation Project:**

   The northern areas of Pakistan serve as a habitat for a number of wildlife species. The survival of these species is under threat. The NACP is a project of WWF-P which is successful in implementing a ban on the hunting of these species.

6. **Conservation of Migratory Birds in Chitral, KP:**

   Chitral lies on the migratory route of several important bird species. These birds face enormous hunting pressure. WWF-P initiated efforts to reduce the hunting pressure in 1992. the efforts proved successful.

7. **Conservation of Chiltan Markhor:**

   Hazarganji National Park is located close to Quetta and is the only remaining habitat of Chiltan Markhor in the country. WWF-P developed the management plan of the park.

8. **Ban on Games:**

   Foreigners visit the northern areas and play many games in which bears are used. WWF-P has been successful in imposing a ban on this illegal practice.

Q. No. 15 Write a note on endangered species in Pakistan.

ENDANGERED SPECIES IN PAKISTAN

Due to human activities, biodiversity in Pakistan is facing a huge loss. Here are a few examples of endangered species in Pakistan:

1. **Indus Dolphin:**

Number:

According to WWF-P. only 600 animals of the species of Indus Dolphin are left in the Indus River.

Reasons for endangerment:

The population of this species declined due to:

- Water pollution
- Poaching
- Destruction of habitat

2. **Marco Polo Sheep:**

Occurrence:

Marco Polo sheep are mostly found in the Khunjerab National Park and nearby areas.

Steps for conservation:

Their numbers have been rapidly decreasing in the last two decades and WWF-P has started projects for its conservation.

3. ***Houbara Bustard*:**

Migration:

This bird flies to Pakistan in the winter season from former Soviet territory and settles in Cholistan and Thar deserts.

Reasons for endangerment:

The decline in its population is due to hunting by foreigners and destruction of its habitats.

REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. **Classification means the grouping of organisms on the basis of:**
   (a) How they feed (b) The features they have in common
   (c) How they respire (d) How they can survive
2. **The kingdom Protista includes:**
   (a) Unicellular and simple multicellular organisms with prominent nucleus
   (b) True multicellular organisms with no prominent nucleus
   (c) True multicellular organisms with prominent nucleus
   (d) Unicellular organisms with no prominent nucleus
3. **Viruses are not classified in any system because:**
   (a) They are too poorly understood (b) They are too small
   (c) Their genetics cannot be determined (d) They are not considered organisms
4. **Viruses are assigned to the kingdom:**
   (a) Monera (b) Protista
   (c) Fungi (d) None of the above

5. **A related group of genera comprises:**
(a) An order (b) A family
(c) A class (d) A phylum

6. **In which kingdom would you classify unicellular eukaryotes?**
(a) Fungi and plantae (b) Fungi and monera
(c) Only protista (d) Only fungi

7. **In binomial nomenclature, the first letter of the _______ name is capitalized.**
(a) Family (b) Class
(c) Species (d) Genus

8. **Which one of the following sequences shows the correct hierarchy of classification, going from smaller to the bigger group?**
(a) Kingdom, phylum, order, class, family, genus, species
(b) Kingdom, phylum, class, order, family, genus, species
(c) Genus, species, kingdom, phylum, order, class, family
(d) Species, genus, family, order, class, phylum, kingdom

9. **Which one of the following may be the correct way of writing the scientific name of an organism?**
(a) *Canis lupis* (b) Saccharum
(c) Grant's gazelle (d) E. Coli

10. **A certain organism is multicellular, adapted for photosynthesis, and has multicellular sex organs, to which kingdom does it belong?**
(a) Animalia (b) Fungi
(c) Plantae (d) Protista

11. **Species that are in the same _____ are more closely related than species that are in the same______.**
(a) Phylum, class (b) Family, order
(c) Class, order (d) Family, genus

12. **When the last member of a particular species dies, the species is said to be ____.**
(a) Established (b) Extinct
(c) Threatened (d) Endangered

13. **In which season *Houbara bustard* migrates to Pakistan and settles here?**
(a) Summer (b) Spring
(c) Autumn (d) Winter

ANSWERS:

1	b	2	a	3	d	4	d	5	b
6	c	7	d	8	d	9	a	10	c
11	b	12	b	13	d				

UNDERSTANDING THE CONCEPTS

(1) Relate the importance of biodiversity with natural ecosystem through examples.

Importance of Biodiversity:

In a natural ecosystem, the variety of Flora and Fauna are extremely important for its characteristics and survival of species.

Biodiversity is important for mankind in many ways:

i. **Food:**

Biodiversity provides food for humans.

Example:

Fruits, vegetables, nuts, seeds etc.

ii. **Drugs:**

A significant proportion of drugs are derived directly or indirectly from biological sources.

Example:

A wide range of medicinal herbs and drugs such as Quinine.

iii. **Industrial materials:**

A wide range of industrial materials are derived directly from plants.

Example: Building materials, fibers, dyes, resins, gums, adhesives, rubber, and oil

iv. **Maintaining Ecosystems:**

Biodiversity plays an important role in making and maintaining ecosystems.

Example:

Formation of communities, food-linkages.

v. **Atmospheric Benefits:**

It helps in regulating the chemistry of our atmosphere and water supply.

Example: Temperature regulation and oxygen supply.

vi. **Recycling:**

Biodiversity is directly involved in recycling of nutrients and providing fertile soils.

Example:

Recycling of nutrients via various biological cycles.

(2) Explain the aims and principles of classification, keeping in view its historical background.

Consult Long Question No. 1

(3) Explain the base for establishing five kingdoms of living organisms.

LIMITATIONS OF EARLIER CLASSIFICATION SYSTEMS

Taxonomists found two and three classifications unworkable because:

i. Many unicellular organisms like Euglena, which have both plant like (presence of chlorophyll) and animal-like (heterotrophic mode of nutrition & lack of cell-wall) characters, needed a separate kingdom.

ii. The difference between prokaryotic & eukaryotic cells was ignored.

iii. There was conflict over placement of Fungi, which were placed in kingdom Plantae. Some biologists disagreed about the position of Fungi in kingdom Plantae. Fungi resemble plants in many ways but are not autotrophs. They are special form of heterotrophs and get their food by absorption. They do not have cellulose in their cell walls, rather they possess Chitin.

BASIS OF FIVE-KINGDOM CLASSIFICATION

- **Cellular organization:**
  The levels of cellular organization, i.e. prokaryotic, unicellular eukaryotic and multicellular eukaryotic.
- **Modes of nutrition:**
  The principle modes of nutrition, i.e. photosynthesis, absorption and ingestion.

(4) Justify why viruses are excluded from the Five-kingdom classification system.

EXCLUSION OF VIRUSES FIVE-KINGDOM CLASSIFICATION SYSTEM

Viruses are at the borderline of living & non-living. They are not considered as organisms, and thus are not assigned any place in the five-kingdom classification system. They have both non-living and living features which distinguish their unique identity.

Non-Living Feature:

- Their nature is crystalline.

Living Features:

- They contain DNA or RNA normally encased in a protein coat.
- They reproduce, but only in living cells.
- They are infectious entities and cause a number of diseases in living cells.

(5) Describe the aims and principles of binomial nomenclature.

Consult Long Question No. 10

(6) Explain the impact of human beings on biodiversity.

Consult Long Question No. 12

(7) Identify causes of deforestation and its effects on biodiversity.

Consult Long Question No. 13

(8) Describe some of the programs running in Pakistan for the conservation of biodiversity.

Consult Long Question No. 14

SHORT QUESTIONS

(1) What is the difference between the modes of nutrition of fungi and animals?

DIFFERENCE BETWEEN THE MODES OF NUTRITION OF FUNGI AND ANIMALS

FUNGI	ANIMALS
• Absorptive mode of nutrition	• Ingestive mode of nutrition
• Major decomposers of ecosystem	• They are not decomposers
• No specialized cavities for digestion	• Specialized cavities present for digestion
• Stationary, cannot move to find food	• Capable of locomotion and finding food
Example: • Mushrooms	**Example:** • Cat, Human beings

(2) **It is difficult to use the criterion of inter-breeding to define species of unicellular organisms, why?**

USAGE OF CRITERION OF INTER-BREEDING FOR SPECIES RECOGNITION

The criterion of inter-breeding cannot be applied for species recognition in unicellular organisms because they do not reproduce by sexual means. They have asexual mode of reproduction.

(3) **How are taxonomy and systematics related?**

RELATIONSHIP BETWEEN TAXONOMY AND SYSTEMATICS

Taxonomy:

The branch of biology which deals with classification of organisms is called Taxonomy.

Systematics:

The branch of biology which deals with classification and also traces the evolutionary history of organisms is called Systematics.

Relationship:

Both these fields are related in the aspect of classifying organisms into various categories, on the basis of similarities. In systematics, evolutionary history is also taken into account.

(4) **Differentiate between the terms 'extinct' and 'endangered'.**

Extinct	Endangered
A species that no longer lives in an ecosystem is called 'extinct' in that ecosystem.	A species is called 'endangered' when it is at risk of extinction in the near future
There is no doubt that the last individual of that species has died	An endangered species a few surviving individuals left.
There is no chance of saving an extinct species.	Endangered species can be saved from extinction if proper measures are taken to preserve it.
Examples: Hangul, Blackbuck	**Examples:** Indus Dolphin, Houbara Bustard

(5) **What are the contributions of Whittaker, Margulis, and Schwartz in taxonomy?**

Role of Robert Whittaker:

In 1967, Robert Whittaker introduced the five-kingdom classification system.

Role of Margulis & Schwartz:

In 1988, Marulis and Schwartz modified the five-kingdom classification of Whittaker. They considered genetics along with cellular organization and modes of nutrition in classification. They classified the organisms into the same five kingdoms as proposed by Whittaker.

THE TERMS TO KNOW

Acellular: An entity which is not made up of cells

Animalia: A kingdom in which eukaryotic, heterotrophic, ingestive organisms are categorized

Binomial nomenclature: Two-word naming system for organisms

Biodiversity: The variety of animals and plants on Earth

Class: A category of classification in which related orders are grouped together

Classification: Division of organisms into groups & subgroups on basis of similarities

Conservation: Preservation of existing flora and fauna of ecosystems to ensure their survival

Deforestation: Cutting down of trees for the conversion of a forest into a non-forest land.

Endangered species: A species at risk of extinction in the near future

Family: A classification category in which related genera are grouped together

Fauna: The variety of animals in an ecosystem

Flora: The variety of plants in an ecosystem

Fungi: Absorptive, eukaryotic, multicellular heterotrophs which are major decomposers of ecosystem

Genus: A classification category in which related species are grouped together

Monera: A kingdom for prokaryotic unicellular organisms like bacteria, cyanobacteria

Order: A classification category in which related families are grouped together

Phylum: A classification category in which related classes are grouped together

Plantae: A kingdom for eukaryotic, autotrophic organisms capable of photosynthesis

Prion: An infectious acellular entity composed of proteins only, not considered an organism

Protista: A kingdom for eukaryotic unicellular or simple multicellular organisms which may resemble plants, animals, or fungi.

Soil erosion: A process of washing away of top fertile soil layers as a result of natural disasters and deforestation.

Species: A group of organisms which can interbreed freely among them and produce fertile off springs, but are reproductively isolated from all other groups in nature.

Systematics: The branch of biology which deals with classification and also traces the evolutionary history of organisms is called 'Systematics'.

Taxon: A group in which organisms are classified

Taxonomic hierarchy: The ladder of classification formed by taxa

Virioid: An infectious acellular entity composed of circular RNA only, and not considered an organism.